Overview of the Aquatic and Riparian Effectiveness Monitoring Program

February 2004

What is AREMP?

The Aquatic and Riparian Effectiveness Monitoring Program (AREMP) is a multi-federal agency program developed to assess the effectiveness of the Aquatic Conservation Strategy in maintaining or restoring the condition of watersheds in the Northwest Forest Plan area (Figure 1). The goals of the program include monitoring current condition of watersheds and changes in condition through time. If the strategy is effective, then the condition of watersheds across the region should either remain the same as it was when the strategy was implemented in 1994, or it should improve--an increasing number of watersheds should be in good condition if the strategy remains in place.

Program Objectives

Present Emphasis:

- Assess the condition of 250 watersheds within the Northwest Forest Plan area by collecting information on upslope, riparian, and in-channel attributes within each watershed.
- Develop and validate decision support models that are used to evaluate the data collected and assess the condition of the watersheds that have been sampled (see pg. 3 for more information).

Future Emphasis:

- Develop predictive models to improve use of monitoring data, potentially reducing the number of attributes measured and long-term monitoring costs;
- Provide a framework for adaptive monitoring at the regional scale; and
- Provide information for adaptive management by analyzing trends in watershed condition and identifying causes of unsuitable or unacceptable conditions.

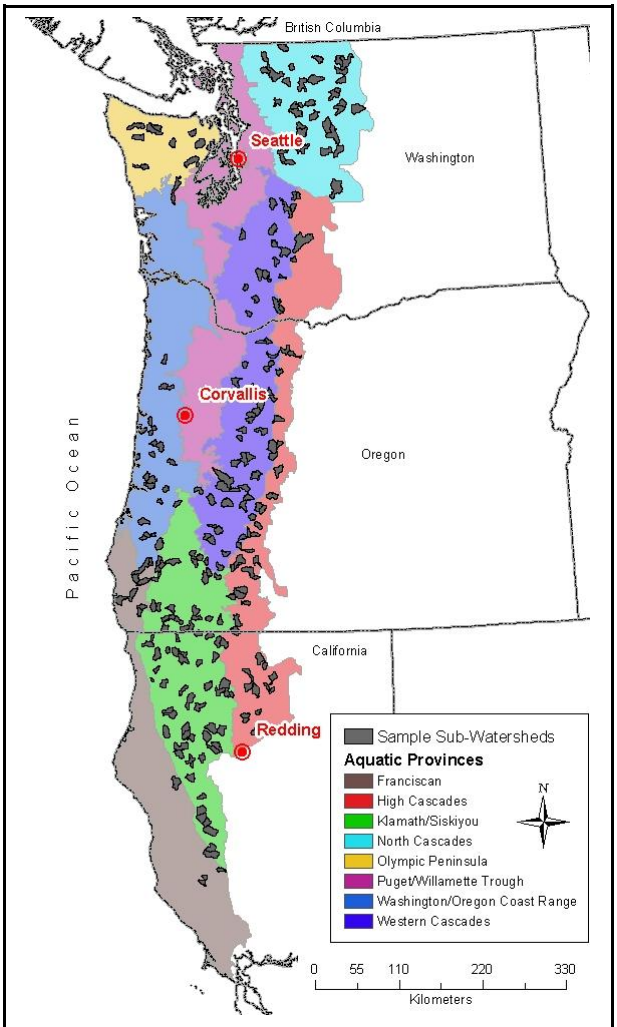

Figure 1. AREMP will be sampling 250-6th field watersheds in the Forest Plan area. This sample size represents about 10% of the total number of watersheds in the Forest Plan area. Watersheds are sampled each year over a 5-year rotation. Data from the upslope, riparian, and stream channel areas are integrated into an assessment of watershed condition.

Monitoring Questions

The questions the monitoring program is charged with answering are related to evaluating the effectiveness of the Aquatic Conservation Strategy in achieving it's goal of maintaining and improving the condition of watersheds in the Forest Plan area. These questions include:

- Are the key processes that create and maintain habitat conditions in watersheds intact?
- Do key indicators suggest that habitat and biotic condition have improved or degraded ?
- How does the proportion of watersheds in good condition change through time?
- Are current management practices attaining the Aquatic Conservation Strategy's objectives?

Watershed Condition, Defined

The definition of watershed condition developed by the monitoring plan was based on the goals of the strategy and on guidance provided by Reeves et al. (2003)[1]. A watershed is defined as being in "good" condition if the physical attributes are adequate to maintain or improve biological integrity, with a focus on diversity and abundance of native or desired fish species. Specific physical attributes include intact upslope and riparian habitats that are biologically and structurally diverse and function properly, i.e., banks that are stable, large wood is present in the stream channel, and sediment and nutrient inputs are similar to natural levels. Flows should be adequate to maintain or improve riparian and in-channel habitat. Chemical characteristics and water temperature must be within a range that maintains biological integrity. Further, the system should be capable of recovering to desired conditions when disturbed by large natural events or by land-management activities.

S. Lanigan

Although this stream in an old-growth forest is considered pristine, fish abundance is very low. The stream channel is scoured down to bedrock, therefore spawning gravel is not available. The channel also has a high width to depth ratio and lacks habitat complexity despite an abundance of large wood.

Because this definition is fish-centric, it is possible to have a watershed with intact processes that is not in good condition from a fish perspective. Watersheds naturally vary in their condition, and they periodically experience natural disturbances. For this reason, it is important to remember that unmanaged watersheds are not necessarily in "good" condition. Although condition may be improving in a recently disturbed watershed, no watershed is expected to be in good condition all the time regardless of the management history. Further, we do not expect all watersheds to be in good condition at any one point in time.

About the Attributes

The monitoring program uses physical and biological attributes that act as surrogates or indicators of watershed processes. Information on roads and vegetation in upslope and riparian areas are obtained using geographic information systems (GIS) analyses. Coverages developed by CalVeg (in California) and the Interagency Vegetation Mapping Project (in Washington and Oregon) are used to determine the percent of the upslope and riparian area with conifers of early, mid, or late-seral stage. Information on roads and streams is used to determine road density in

[1]Reeves, G.H., D.B. Hohler, D.P. Larsen, D.E. Busch, K. Kratz, K. Reynolds, K.F. Stein, T. Atzet, P. Hays, and M. Tehan. 2003. Aquatic and riparian effectiveness monitoring plan for the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-577. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

riparian, upslope, or hazard areas and the number of road-stream crossings in each of the watersheds. A landslide assessment will soon be added to the evaluation.

Stream channel physical and biological attributes are measured at multiple randomly selected locations in the watershed, covering a distance 20 x the bankfull width, with minimum and maximum reach lengths of 160 and 480 m respectively. Physical attributes that are measured include bankfull width and depth, entrenchment ratio, gradient, sinuosity, substrate (D50 and pool tail fines), pool frequency, and wood frequency. Biological data are collected on fish, aquatic and terrestrial amphibians, benthic invertebrates, and periphyton. Sampling protocols can be downloaded from our website. A data quality assurance/ quality control program has also been implemented, with the following: formalized field training, remeasurement of a subset of sample sites by an independent field crew, field audits, and crew exit surveys.

AREMP employees use electrofishers as part of the biological sampling conducted in each watershed.

What's a Decision Support Model?

Decision support models document decision processes and allows the same process to be applied consistently across time and space. The models developed by the monitoring program are used to evaluate whether a particular watershed is in good condition. Decision support models work by evaluating individual attributes (such as road density) and calculating an evaluation score for each attribute. The model then aggregates the evaluation scores of all attributes into a single watershed condition score.

Using decision support models has numerous advantages because assessments are repeatable, they can be conducted at any spatial or temporal scale, and they can handle multiple data formats. More importantly, as our understanding of how watersheds function increases, models can be refined and rerun on data from earlier time periods to correct deficiencies. Additional information on decision support models and the software used to run them, can be found on our website.

Managers use our decision support models to estimate impacts of management activity on resources and for prioritization. Assessments are transparent, explanations to stakeholders are easy and logical.

Model Construction and Refinement

The Northwest Forest Plan encompasses more than 24 million acres of federal lands in the Pacific Northwest. Stream and riparian habitat conditions vary greatly across the Forest Plan area because of natural and management-related factors. For example, precipitation ranges from several hundred inches per year near the coast to less than 20 inches per year on the east side of the Cascade Range. To account for the diversity within the Forest Plan area, a decision support model is being constructed, refined, and peer-reviewed for each of seven different physiographic provinces (Figure 1) during workshops attended by local agency professionals. The workshops consisted of an informal group process through which participants came to consensus on how the model evaluated individual attributes and aggregated the scores of individual

(left to right) Tom Robison, Okanagan/ Wenatchee NF, Gary Ketcheson and Jim Doyle from the Mt. Baker-Snoqualmie NF were three of nearly 50 participants who provided technical expertise and local knowledge for decision support model construction and refinement.

attributes. Participants examined each attribute class (e.g., roads). For each class, groups identified the processes that should be accounted for in the model, then selected the attributes that were the best surrogates for each process. For example, in the roads evaluation, attributes were selected to describe the hydrologic connectivity of the road with the stream, the potential for mass failure, and floodplain constriction. As we discussed each attribute, we developed evaluation criteria and determined how the attribute evaluation scores should be aggregated.

The decision support model integrates information collected in the stream, riparian, and upslope areas. With this approach, we can take a comprehensive view of watersheds.

Following the workshops, models were constructed and run, and the results are being returned to the workshop participants. Participants compare the model results with their knowledge of the condition of watersheds and suggest refinements to the model as necessary. The suggested changes will be made to the model and the new results will again evaluated. Data from the 2001 and 2002 field seasons are being used during the refinement process, and data collected during the 2003 field season will be used to validate the models.

While constructing each model, numerous decisions were made (for example, evaluation criteria values) that were based on data, published literature, and professional judgment. As part of the quality assessment of the model and its results, we documented the basis for each decision as well as each workshop participant's confidence in the decision.

AREMP Products

Everything produced by the monitoring program, including data, models, and reports is available. A database that contains all field and GIS data is currently maintained by the monitoring program. Data requests should be directed to Chris Moyer.

The decision support model and evaluation criteria will be distributed to local units for their use when the refinement process is complete (summer 2004). Questions regarding the decision support model should be directed to Kirsten Gallo.

Annual progress reports and other Northwest Forest Plan monitoring information are located on our website. Data summary reports for each watershed sampled are distributed to local units each year to provide data and other products. Forthcoming reports in 2004 include:

- 10-year Interpretive Report for the Forest Plan,
- the decision support model construction and peer review process,
- the monitoring program evaluation, and
- the data quality assurance/ quality control (QA) plan, with the results from this program.

Want to know more?

For more information, visit our website

www.reo.gov/monitoring/watershed

or contact one of us directly.

- Steve Lanigan, Team Leader, 503.808.2261, slanigan@fs.fed.us
- Peter Eldred, GIS Coordinator, 541.750.7078 peldred@fs.fed.us
- Kirsten Gallo, Aquatic Ecologist, 541.750.7021 kgallo@fs.fed.us
- Chris Moyer, Fish Biologist, 541.750.7017 cmoyer@fs.fed.us

This overview was written by Kirsten Gallo.